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I

**President's Report
and Future Research
Possibilities Discussed
at the Board of Directors'
Spring Meeting, 1974**

**ENERGY, THE ENVIRONMENT, AND THE ECONOMY:
AUTOMOBILES AND AIR QUALITY AS A CASE STUDY**

JOHN MEYER AND GREGORY INGRAM

Introduction

Almost certainly the outstanding economic event of 1974 was that combination of problems, consequences, and unusual developments associated with the phrase "the energy crisis." It meant many things to many people. It had many implications, both short run and long run. In the short run it confronted the nation with many new and unexpected economic problems. To start, there was the large drop in U.S. real GNP in the first quarter of 1974; rarely in recent history had such a sharp decline in economic activity been so concentrated or less diffused. In addition, large and uncertain swings occurred in balances of payments. Some industrialized or developed countries did better than expected and some fared not so well. Several less-developed countries faced in a new and more startling form their constant, ever-recurring problem of adequately clothing and feeding their people. Financial people everywhere discussed how to "recycle" the exceptional surges in earnings experienced by oil-producing countries so as to tide over those consuming nations experiencing temporary (or more permanent) foreign exchange crises, all the while attempting to avoid an outbreak of trade wars or worldwide recession. Perhaps most surprisingly, for the first time in two decades or so governments of the industrial West contemplated, or in a few cases even

implemented, rationing schemes.

The longer-run implications of the energy crisis were perhaps even more fundamental. In particular, a long and festering dispute both within and outside the field of economics about the meaning, validity, and desirability of economic growth was brought to the fore. The stage was also set for a remarkably dramatic test of the ability of the market mechanism to compensate for supply shortages. Economists had long been skeptical of apocalyptic forecasts of the imminent depletion of natural resources. They believed that scarcity would induce price increases that would in turn induce consumers and producers to find substitutes for scarce goods or factors of production long before any scarcities became a serious problem. Many physical scientists and engineers, on the other hand, foresaw the world pursuing fixed production and consumption patterns, regardless of prices and other market signals, into ruinous exhaustion and depletion of available resources. Early experiences with the energy crisis seemed to provide some sustenance for both viewpoints!

Inevitably, the energy crisis also focused public attention on environmental issues and led to a serious reevaluation of certain recent public policies in this area. Specifically, the energy crisis moved the discussion of environmental issues into a more sophisticated and mature

phase in which previously neglected economic questions, such as what are the benefits and costs of these environmental programs, became acutely sensitive and important.

It would be gratifying to report that National Bureau research had anticipated all of these new or suddenly more prominent energy and environmental issues. It would be even more gratifying, of course, if such research had provided a factual basis for the resolution of these problems. Unfortunately, Bureau research anticipated these new developments dimly at best and provided only a small bit of the factual knowledge required to deal with the myriad of problems that the energy crisis raised.

During the past year, however, we did publish a first attempt at estimating international capital flows, thereby providing at least a part of the factual basis for assessing such problems as the recycling of oil royalties or determining the dimensions of a new international monetary equilibrium.¹ We also continued our research on problems of exchange rate adjustments of less-developed countries; these studies, hopefully, should shed some light on the new or additional complexities of financing economic development in the less-developed parts of the world facing high energy and food costs.² One could also argue that the Bureau's ongoing research on the causes and diagnoses of business cycle phenomena would help analysts understand the relatively new phenomenon of a retardation in economic activity apparently created by supply shortages, just as such research was pertinent to previous recessions created by insufficient demand. As much as one might have wished for a more complete research program and factual basis for dealing with the short-run problems of the energy crisis, these bits and pieces of research were at least relevant and somewhat helpful.

On the longer-term issues, essentially involving the meaning and evaluation of economic growth, the Bureau had also been at work, though much was still to be done. The Bureau's

program dealing with problems of social measurement (or more precisely with how the national income accounts might be augmented or extended to better reflect different and more complex facets of economic development) continued and began to yield some results.³ Furthermore, as a by-product of the Bureau's program for modeling urban growth and development patterns, the Bureau also became involved for the first time in studies relating to environmental issues, so inextricably intertwined with those of energy. Specifically, the Bureau completed during the past year some preliminary studies on the relationship between economic development and the demand for water used in industrial processes,⁴ an investigation that was a quite natural extension of our ongoing work on industrial location decisions. Similarly, some members of the Bureau's urban research group undertook to apply their knowledge of urban transportation problems to understanding the relationships among at least the cruder dimensions of location patterns, transportation choices, and the creation of air pollutants in urban areas. In particular, several of the Bureau's staff became involved in an advisory capacity to a committee of the National Academy of Sciences that in essence had been asked to determine "what are the benefits and costs of emissions controls on mobile sources of air pollution?"⁵

The National Bureau's work in helping this National Academy Committee in its deliberations is perhaps a particularly apt illustration of the potential complementarity between basic ongoing research at the Bureau and the evaluation of specific policy problems in our society. As such, and given the timeliness of the subject, it seems appropriate to devote some particular attention to a review of our work in this area, always recognizing that any results reported are quite tentative and preliminary.

³ See the progress reports in Part II under Measurement of Economic and Social Performance.

⁴ See the progress report by Robert Leone, J. Royce Ginn, and An-loh Lin in Part II under Urban and Regional Studies.

⁵ The co-authors of this introduction are, respectively, the chairman and the executive director of the National Academy of Sciences' Committee on the Costs and Benefits of the Automotive Emission Standards.

¹ Raymond F. Mikesell and J. Herbert Furth, *Foreign Dollar Balances and the International Role of the Dollar* (New York: NBER, 1974).

² See the reports by Jagdish Bhagwati and Anne Krueger in the International Studies section in Part II of this report.

**The Clean Air Act of 1970:
A Policy Problem in Need of
Further Research**

The Clean Air Act of 1970, as almost everyone now knows, set very ambitious standards. Partly because of its innovative goals, the act has also created a good deal of controversy. Many felt that the standards set were much too stringent, particularly those for automotive or mobile emissions. As a result, the policy commitments in the original 1970 legislation could entail very heavy costs for American society. Official estimates suggest that \$25 to \$30 billion will be needed annually for all environmental programs for at least the next decade or so. Some even have suggested that the air quality act alone could cost \$60 billion annually. Even if the \$60 billion annual estimate is badly inflated, which it probably is, it seems difficult to place the costs of meeting the original air quality standards much beneath \$15 billion annually; and \$10 to \$20 billion of annual outlays is not a totally unrealistic estimate of what might be required to clean up auto emissions alone.

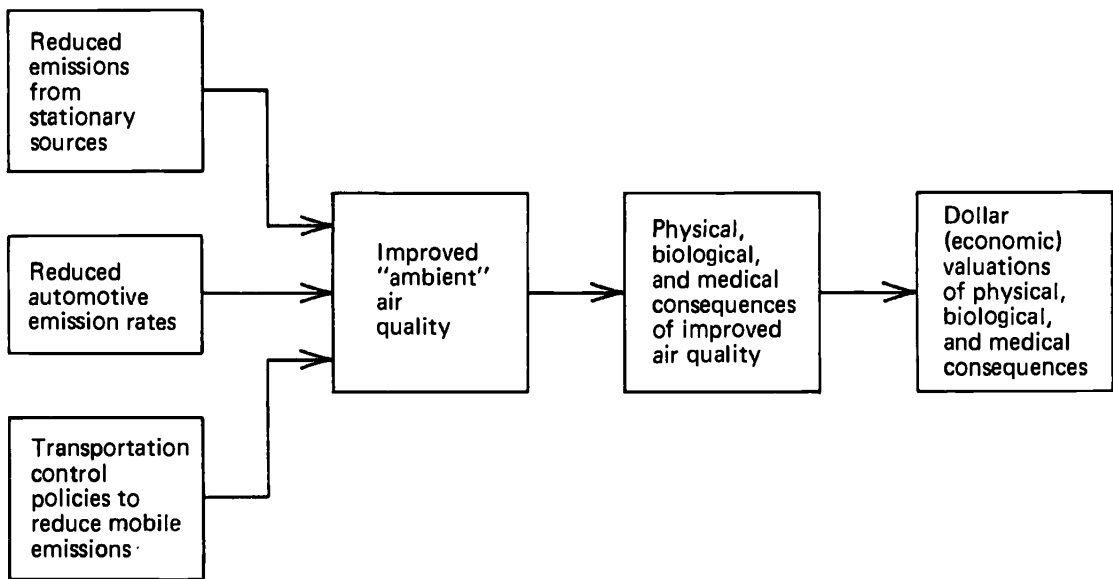
With such large sums at stake, it is natural enough to question whether the expenditures

are worthwhile. Unfortunately, we really don't have the knowledge to answer that question very precisely. No little uncertainty exists, for example, about the costs of reducing vehicular emissions, and the uncertainties about the benefits produced by reducing emissions are much greater. The truth is that clean air legislation constitutes an almost classic example of policy potentially outrunning knowledge and research.

The best way of quickly grasping the extent of the imponderables is to look at an overall schematic of what would be involved in doing a benefit cost evaluation of emission controls, as shown in Figure I-1. In essence, almost every one of the arrows in Figure I-1 connotes a large area of uncertainty, or an important information gap.

To start, there are missing elements in our knowledge about the essentially technological questions (as denoted by the far-left arrow in Figure I-1) of how reduced emissions from autos, factories, and other sources will improve ambient air quality. The answers to these questions may seem obvious, but they really are not. For example, the relation between emissions of primary pollutants such as hydrocarbons and oxides of nitrogen and the formation of second-

Figure I-1
B/C Evaluation of Emission Controls,
a General Schematic



ary pollutants such as photochemical smog cannot be specified very accurately. Additional complications are introduced when cures for one type of emission problem may actually worsen other types of air pollution. For example, catalytic mufflers, which should permit automobiles to meet the most stringent emission standards of the 1970 Clean Air Act, may actually produce new health problems by increasing automotive emissions of presently uncontrolled substances. Specifically, some scientists contend that certain sulphate particulates may be emitted by the catalytic mufflers, which in the atmosphere or in people's lungs could be converted into sulfuric acid, with serious effects on human health. If we take a broader view of the pollution problem, we can also observe that some improvements in air quality may be "bought" at the expense of worsening other environmental problems; for example, low-sulfur fuel may help reduce air pollution, but it may also complicate meeting certain water pollution standards.

Similarly, moving to the arrow in the middle of Figure I-1 (mapping improved ambient air quality on to physical, medical, and biological consequences), we really do not know the extent to which an improvement in ambient air quality actually improves health, conserves materials, reduces structural maintenance, or contributes to better environmental or recreational enjoyment. The truth is that medical, engineering, and economic evidence on these points is very incomplete and uncertain. For example, epidemiologists have found associations between various health effects and sulfate and particulate pollution, but have found few associations among health effects and carbon monoxide or oxides of nitrogen. Simultaneously, many clinical investigators have found that high short-term concentrations of nitrogen oxides and carbon monoxide produce marked physiological changes, whereas short-term exposure to sulfur oxides produces few responses. Of course, these findings are not necessarily inconsistent. Clinicians might be quite right in observing that short-term exposures to high concentrations of some pollutants do harmfully affect at least certain classes of people. On the other hand, epidemiologists, who work more with broad aggregates, are undoubtedly more successful at

identifying chronic health effects associated with long-term exposure to low concentrations of pollutants. Needless to say, combining the results of clinical experiments with epidemiological studies to predict the consequences of reduced exposure to pollutants is no easy task. Nevertheless, it is clearly difficult to evaluate, let alone justify, major air quality improvement programs without determining the extent of the physical consequences of improved air quality.

The third, or far-right, arrow in Figure I-1 denotes a basic set of questions that are essentially economic in character. Specifically, what is the value—in dollars and cents if possible—of the health, material, agricultural, and other improvements attributable to clean air, both in the aggregate and at the margin? In short, if polluted air is harmful, what is it costing us? Incidentally, the marginal values are crucial to evaluating different air quality standards if the achievement of these standards are at all costly and these costs respond other than linearly to revisions in the standards. Unfortunately, almost no evidence is available on what these marginal costs and relationships might be. Rather, what few estimates we do have about the value of benefits that might be attributable to cleaner air tend to be aggregates. Thus, the Environmental Protection Agency's current best guess about these aggregates is on the order of \$14 to \$16 billion annually. Some other observers would tend to put the figures lower, sometimes at an aggregate level no higher than \$4 to \$6 billion annually. Obviously, quite a range separates the higher from the lower of these estimates.

In addition to these quite basic questions about benefits, we also should know what it would cost to implement alternative policies for reducing emissions. In terms of Figure I-1, such studies could be characterized as cost-effectiveness analyses for achieving or implementing the various policy actions shown in the three left-hand boxes; that is, for reducing emissions from stationary sources, reducing automotive emission rates, and implementing transportation control policies to reduce emissions. These cost effectiveness questions are involved, but in many respects they are not quite so difficult as the basic health and benefit evaluation questions just described. Nevertheless, as pointed out in

the next section, they do require quite complex systems analyses. One might add that these analyses are only beginning to be understood, let alone done.

The Cost Effectiveness of Transportation Control Policies for Achieving Clean Air in Boston: An Illustrative and Preliminary Analysis

The minimal components of a "systems-analytic" model for evaluating the effectiveness of different urban transportation control policies in achieving cleaner air in an urban area are as shown in Figure 1-2. At least three different ingredients are required: (1) a transportation submodel that indicates how people respond in their urban transportation choices to different incentives and basic environmental circumstances; (2) an air emissions submodel that indicates how different transportation choices translate into emissions of different pollutants; and (3) a diffusion submodel that transforms the emissions of different pollutants into pollutant concentrations over the urban area being analyzed, allowing not only for different kinds of emissions but also for meteorological and other factors that might be expected to influence the diffusion of pollutants.

To provide a systems analytic capability for our National Academy Study, we built on previous efforts in developing these various submodels and linking them together. Thus, our transportation submodel embodies a standard urban transportation planning model adapted to a system of large zones with a special treatment of transit mode choice. The emissions submodel incorporates speed-emission relations, deterioration factors, and emission rates compiled by the Environmental Protection Agency. The diffusion submodel combines simple diffusion models developed by meteorologists. These submodels had been integrated into a unified transportation and air shed simulation model in previous studies (undertaken in other connections by Bureau staff members helping with the National Academy task).⁶

⁶ The simulation model, named TASSIM, was developed under an NSF-RANN grant and further documented for the U.S. Dept. of Transportation. See Gregory K. Ingram, "Simulating the Urban Air Pollution Environment," Chap. 5

It is in the context of such a combination transportation and air shed simulation model that transportation control and other non-auto transportation policies for improving ambient air must be evaluated. Interest in these other transportation solutions is essentially twofold. First, there is the hope or expectation that such solutions might be less costly to implement than those aimed directly at reducing automotive emission rates. Second, other transportation solutions could be a necessary supplement to reduced automotive emission rates. Thus, for some American cities the Environmental Protection Agency has adopted a position that other transportation solutions will have to be implemented *in addition* to reducing automobile emissions if proper standards of ambient air quality are to be achieved.

Transportation controls and other transportation solutions can take several forms. For instance, typical transit-oriented solutions that have been suggested include (1) expanding or creating rail transit systems to wean people from commuting by auto; (2) making transit relatively more attractive by instituting express bus services that would move on specially reserved, uncongested highway lanes; (3) lowering transit fares in order to provide an economic incentive for commuters to shift from autos to transit; or (4) creating more private transit in the form of jitneys or car pools, or otherwise increasing auto occupancy levels in urban travel.

Traffic restriction schemes are another broad group of transportation control policies. Among the many possibilities in this classification would be (1) surcharges for central parking, particularly all-day commuter parking, so as to provide an incentive for people to switch from auto to transit; (2) imposing special license fees for gaining access to central business areas; (3) outright prohibition of auto access to central urban areas; (4) restrictions on auto speeds in urban areas (hopefully enforced!) so as to reduce gas consumption and make transit more

in *The Automobile and the Regulation of its Impact on the Environment*, Final Report, Grant NSF-GI-29965 (forthcoming); or Gregory K. Ingram and Gary Fauth, *TASSIM: A Transportation and Air Shed Simulation Model*, Vols. 1 and 2, Final Report, Contract DOT-OS-30099, May 1974.

attractive; or (5) metering access to urban expressway or freeway facilities so as to reduce the traffic congestion on such facilities during the rush hours, thereby reducing high-pollution stop-and-go travel.

Land use policies also have been advanced as a means of improving the ambient air quality in urban areas, policies sometimes strikingly varied and often contradictory. Some entail that employment and residences in urban areas be centralized, or concentrated, so as to encourage more transit use and walking, thereby reducing the pollutants emitted from mobile sources of urban transportation. Others would continue the decentralization of employment and residences so as to reduce peak activity and pollution concentrations in urban areas and in particular to reduce exposures to pollution levels considered unsafe to health.

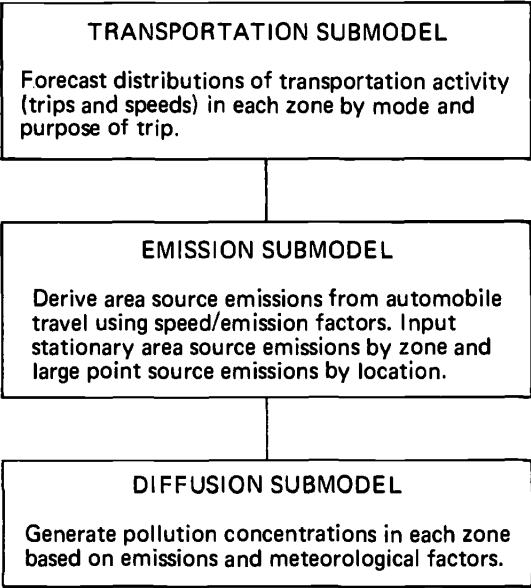
A number of other, less expensive automotive strategies for achieving clean air might also be suggested, strategies that go beyond simply reducing the emission rates of present standard-sized American automobiles. For example, smaller cars might be substituted. Smaller cars not only consume less gasoline but they should also reduce the costs of achieving certain specified levels of emissions standards. The National Academy of Sciences' Committee on Motor Vehicle Emissions has estimated that if compacts or subcompacts in the 2,000- to 3,000-pound range were used instead of standard-sized American cars of 4,000 pounds or so, annual costs of achieving automotive emission control standards could be reduced by \$100 to \$150 per vehicle.⁷

Several of the transportation control and other transportation policies just described have been investigated by applying a systems analysis of the type outlined in Figure I-2 to the Boston area. Figure I-3 displays two levels of effectiveness, one local and one regional, that correspond to several of the candidate transportation policies. The local measure is essentially the predicted percentage reduction in carbon monoxide concentrations in central Boston. The regional measure, somewhat more sophisticated, is an at-

tempt to measure the millions of person-times of exposure to pollutant levels exceeding minimal health standards across the entire Boston metropolitan region.

Some suggestive inferences can be drawn from the Boston experience, always remembering that that experience may not generalize to all American urban areas or situations. First, certain of the transportation control policies clearly are not very effective in reducing harmful air emissions from mobile sources. Indeed, some may even prove harmful. For example, almost anything that increases auto speeds, especially in central urban areas, seems to do rather more harm than good; apparently, improvements in auto speeds, if the transport travel forecasting devices embedded in the transportation model are correct, induce sufficient new traffic so that any reduction in the total pollution per mile traveled is more than offset by increases in miles traveled. Similarly, transit extensions (as represented in this case by those currently planned by the Massachusetts Bay Transportation Authority's master plan), are predicted to have almost no effect in terms of reducing downtown concentrations of carbon monoxide and actually to have some harmful effects by the regional effec-

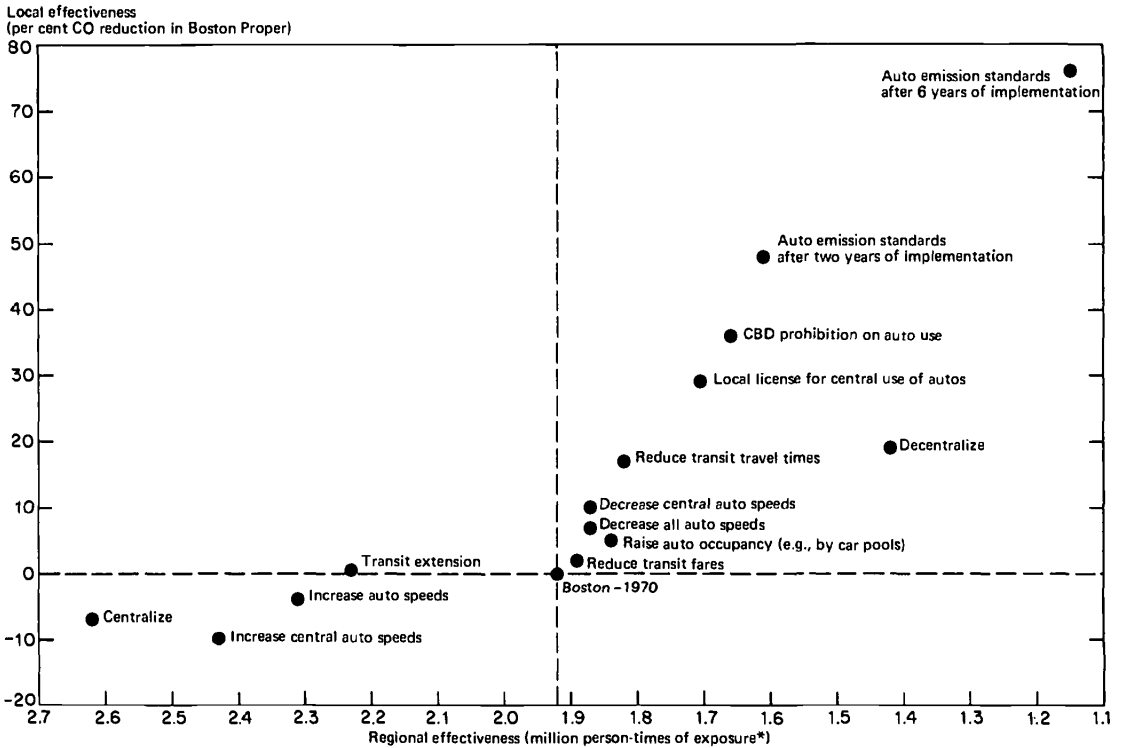
Figure I-2
Major Components of a Transport
and Air Shed Simulation Model



⁷ Report by the Committee on Motor Vehicle Emissions, National Academy of Sciences, Washington, D.C., February 1973, esp. Table 5-4, p. 101.

Figure I-3

Local and Regional Effectiveness of Various Transport Policies
for Reducing Air Emissions in the Boston Region



*To ambient levels exceeding "minimal" standards.

tiveness measure. Likewise, a centralization of activities, which in this case was tested by relocating to central areas 20 per cent of suburban residences and work places, is predicted to have a generally deleterious effect, particularly in terms of the regional standard.

The other striking result is how effective the automotive emission controls are predicted to be. The improvement, incidentally, in the achievement of the auto emissions standards after differing years of implementation is essentially due to the fact that a typical American automobile lasts about ten years, so that the total percentage of the active automobile fleet with reduced emissions increases as the number of years of higher standards for new cars increases. If the Boston results are indicative, achieving ambient air quality standards will require a significant reduction in automobile emissions.

It is perhaps ironic that the two "other trans-

portation" strategies that seem to be most promising—CBD prohibition on auto use and local licenses for central use of automobiles—may also rank as the politically most difficult to implement. On the other hand, a policy of decentralization (which in this case was a mirror image of the centralization policy, or, a 20 per cent reduction in central residential and work place densities) is something that seems to be happening without particular policy incentives and does seem to be helpful in reducing harmful emission exposures.

The results shown in Figure I-3 are, of course, totally devoid of any cost considerations. Toward calibrating these "other transportation" policies against their cost, some crude estimates were made of what each policy might cost to implement in the Boston region. It should be stressed that these cost estimates are first approximations at best, although probably correct hierarchically if not in absolute terms. These cost

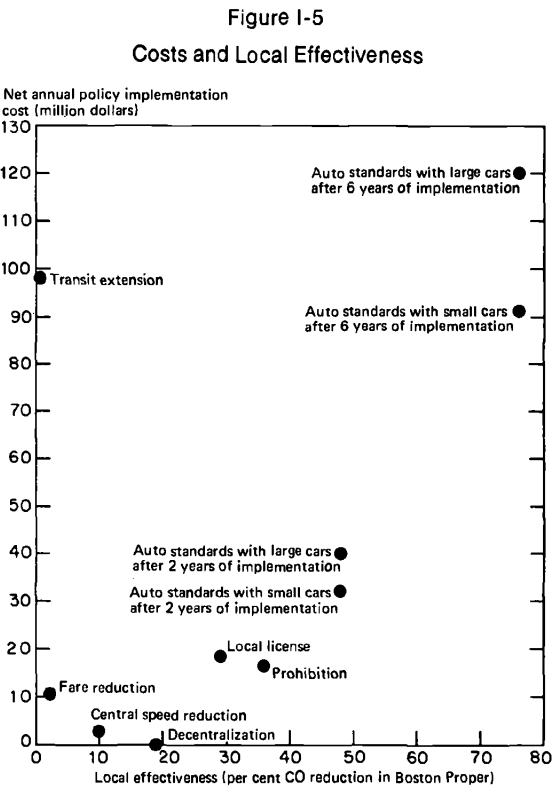
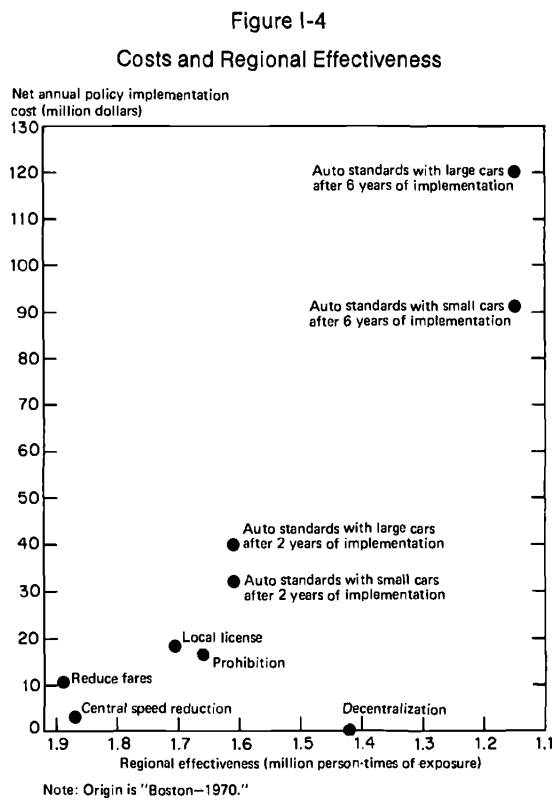
estimates are plotted against regional effectiveness in Figure I-4 and local effectiveness in Figure I-5. (In both figures I-4 and I-5 decentralization is shown as a zero-cost policy on the ground that this is something that might occur over several years without any specific policy actions or inducements.) The high costs of implementing the auto standards (these costs augment rapidly with years of implementation) coupled with the basically high achievement levels of these policies suggest that in air clean-ups, as in most things, "you get what you pay for." The small-car, large-car comparisons, incidentally, represent rough estimates of what the total annual savings might be in the Boston area by modifying the present (end of 1973) mix of large and small cars with a mix of automobiles in which small cars only were added to the fleet after the new and stricter automotive emissions standards are implemented. In short, the small-car cost estimates shown in Figures I-4 and I-5 would be those that one might expect if no more large cars were added to the Boston fleet if and when strict emissions standards are actually enforced.

"Other transportation" solutions are clearly not overwhelmingly effective, at least as compared with actually cleaning up automotive emissions. Nevertheless, they should perhaps not be dismissed too quickly. These policies do help somewhat in cleaning up the air and they are not overwhelmingly expensive. Nevertheless, a strong suggestion emerges that a reasonably thorough improvement in urban air quality will require a significant reduction in automotive emission rates, and that this in turn will require a fairly substantial expenditure of funds.

Conclusion

It should be stressed that the results embodied in the figures of this presentation are necessarily very crude and approximate. Furthermore, even if the cost estimates and analytic results are correct as reported, there are still some very difficult choices to be made, choices that eventually must be faced by Americans acting through their political institutions or by recording their consumer preferences in markets. The research, at best, provides only somewhat better information for making these choices.

It can hardly be overstressed, moreover, how



imperfect the information for making these choices remains. The required research is obviously well beyond the resources, intellectual or financial, of an organization such as the Bureau. Energy and environmental issues are prime illustrations of problems that need the skills and disciplines of many different professions, and the fundamental issues involved are at least as much medical and technological as they are economic in character.

Although recognizing the inherent limitations of purely economic analyses in these matters, the Bureau will nevertheless continue to do as much as its resources permit in developing the requisite knowledge for better evaluating these issues in the future. That future, incidentally, should be quite long-lived, since these issues should be with us for some while to come. The form and content, however, may change drastically—for example, perhaps the world really will be awash with oil within two to five years, as some predict—but the fundamentals should not change much regardless of where the immediate policy emphasis is placed. The research ob-

jective, accordingly, should be to improve our knowledge of those fundamentals.

In this area, as in so many others, the need is for systematic and factually objective analyses to inform public decisions. Meeting these needs is very much in Bureau tradition. In the introduction to this report we cited several studies that were relevant to the particular problems created by the "Energy Crises of 1974." We could have provided other examples from several other areas in which the Bureau is involved and has had a long interest, such as public finance, education or human capital studies, law and economics, health and medical care, or urban problems (such as housing abandonment and allowance schemes). In all these efforts the relevance of Bureau research may not always have been immediately evident, as it has often been quite basic in character. Nevertheless, in most instances this basic research has, in time, led to analyses potentially useful to evaluating public policies and problems—even when the exact identity or character of those problems has not been fully anticipated.

INFLATION ACCOUNTING: ISSUES FOR RESEARCH

SOLOMON FABRICANT

Efforts to measure labor income free of the effects of changes in the prices paid by workers have a long history. Indexes of food prices at retail became available in the United States around 1900. Comparison of changes in wages and salaries with changes in the important food component of the cost of living promptly followed. A more comprehensive measure of change in consumer price levels, covering also nonfood items, was demanded and became available during the great inflation associated with World War I. This consumer price index, applicable to urban wage earners and clerical workers, has been available on a regular basis ever since, and it has been gradually improved in coverage and accuracy. Indexes of wage and salary income are now as a matter of course accompanied by this index of consumer prices and attention is paid no less to real than to money labor income in discussions of the changing economic status of labor. In a word, "deflated" wages and salaries are a commonplace.

Systematic allowance for change in prices paid when assessing the economic well-being of farmers came later, in the 1930s, when the "parity" idea was introduced and implemented under the Agricultural Adjustment Act. Like labor income, farm income—the return from capital investment and "entrepreneurship," as well as labor—is now regularly reported in constant as well as current dollars.

In the case of nonfarm property income, deflation to take account of change in the purchasing power of money has lagged to a surprising—and to many people, a disturbing—extent. Corporate reports on profits earned during the year or quarter, whether made to stockholders, tax collectors, public utility commissions, "cost of living councils," or the public at large, are calculated on the basis of "generally accepted accounting principles." In particular, the dollar is assumed to be a stable unit of measurement. Virtually no report, therefore, makes any allowance for change in the general price level. During a period of inflation, reported increases in

profits inevitably exceed increases in "real" profits.

Even the information on profits that is currently prepared by economists and statisticians for use in following the current economic situation is deficient in this regard. The first appearance of a deflated corporate profit series in the monthly *Business Conditions Digest* and other publications of the Department of Commerce occurred only a couple of years ago. No deflated corporate profit series yet appears in *Economic Indicators*, prepared by the Council of Economic Advisers for the Joint Committee of the Congress. This monthly periodical, distributed to all members of Congress, and presumably widely used by them, publishes deflated income series only for labor and farmers. Such components of property income as dividends, interest, and rents are shown, both in *BCD* and *Economic Indicators*, deflated not separately but only in combination (along with labor and farm income) in the aggregate of personal income.

The overstatement of increases in business profits—or understatement of decreases—has worried thoughtful citizens. They are concerned about the implications of this overstatement for business decisions generally, investment in particular, and taxation, price and wage controls, and economic forecasting. And this has led some of them to suggest the desirability of a study of "inflation accounting" by the National Bureau.

This concern has, of course, been intensified by the very rapid inflation that the American economy has been experiencing in recent years. The failure of conventional accounting practice to deal adequately with changing price levels is an old worry, however. Twenty-five years ago George May and Percival Brundage organized a "Study Group on Business Income." Ten years ago the Accounting Research Division of the American Institute of Certified Public Accountants made another study of the question. Five years ago the Accounting Principles Board of the AICPA issued its "Statement No. 3" recom-

mending—but not requiring—supplementary statements disclosing the effects of changes in the general price level on the financial accounting measurements. Yet these studies and statements have had virtually no effect on current accounting practice.

Only very recently have there been any signs that the accounting profession as a whole may finally be coming to recognize the need to allow for changes in the general price level, in business accounts, and to do something about it. Just a few weeks ago the Financial Accounting Standards Board, the successor to the Accounting Principles Board, held a public hearing on the issues involved. It is possible—perhaps even moderately probable—that the Board will require supplements, to the usual financial statements of widely held corporations, that allow in one way or other for the decline in the purchasing power of the money used as the unit in business accounts. A similar discussion going on in Britain may be closer to affecting accounting practice. In a few countries—not many—some sort of adjustment for changes in the price level is already in fairly general use, as a recent compilation by Price Waterhouse indicates.

Many difficult problems arise when one attempts to correct financial statements for inflation. The BCD's simple deflation of the reported profit series is, no doubt, a major step toward recognizing changes in the value of money. The rise in corporate profits before tax between 1966 and 1973, for example, reported in current prices as 40 per cent, is under 10 per cent when measured in constant prices. But how thoroughly this deflation corrects for reduction in the value of the dollar is a matter of considerable controversy. The BCD deflated series is derived simply by dividing profits, as accountants calculate them, by the GNP implicit price deflator. Three groups of questions arise about the validity and accuracy of the result. One concerns the current dollar profit figure, reported in the usual corporate income account or profit and loss statement, that is deflated. Another concerns the deflator. And a third concerns the purchasing power gains or losses, realized or not, on monetary and nonmonetary assets and liabilities when the value of money changes—gains or losses not covered in the deflation of the re-

ported profit series.

Reported profits, such as are shown in annual or quarterly reports and mentioned in the daily press, are not good measures even of profits expressed in current prices. The reason is well known to economists and accountants. Certain important elements of current cost are calculated in the prices paid in earlier periods, not in current prices. When price levels are moving up, original cost prices may be significantly below the prices of the current period, the period for which profits are being measured.

One such element of cost is that of withdrawals from inventory of material, components, goods in process, and the like, that were used in producing the goods or services sold during the year or quarter. With the so-called "last-in-first-out" method of costing inventory withdrawals, the charge to current operations is at something reasonably close to current prices. But LIFO is in fact used only to a limited extent in calculating corporate profits. When prices are rising rapidly, the under-estimation of the cost of withdrawals from inventory may be large. In 1973 this cost may have been understated, to cite a round number, by some \$15 billion.

Similarly, depreciation and obsolescence changes are generally based on the prices prevailing in earlier years—indeed, many more years earlier, as a rule, than withdrawals from inventory. Yet no effort is made by accountants, when calculating business profits, to substitute for the original cost of plant and equipment the current replacement cost, or, alternatively, the original cost adjusted for change in the general price level. The difference between original and current cost of capital equipment used up in any year may be greater or less than the difference in the case of inventory withdrawals; it depends on the course of the price level up to that year. In 1973, it so happened, depreciation and obsolescence charged at original cost understated the charge at current cost also by around \$15 billion.

In the national income and outlay accounts prepared by the Department of Commerce, it should be noted, the cost of withdrawals from inventory is adjusted (although only approximately) to the current price level by means of the department's "inventory valuation adjustment."

However, even in the national accounts no adjustment is yet made for the fact that under current accounting practice depreciation and obsolescence are charged at less than current cost.

Returning to the profits reported in corporate financial statements, if the estimates mentioned are near the mark we must conclude that the use of original cost in determining charges for inventory withdrawals and depreciation and obsolescence meant that 1973 profits before income tax, reported as \$118 billion, were overstated by as much as a third. Furthermore, the degree of overstatement of profits in 1973, measured in 1973 prices, was greater than the degree of overstatement of profits in 1972, measured in 1972 prices. The deflation procedure followed in BCD to put profits in all years on the same price basis (that of 1958) does not correct this upward bias in the rate of change of profits.

Conventionally measured profits may suffer also from biases in the opposite direction—biases that depress rather than overstate both the levels and the rates of change of profits. These biases could serve to offset—whether more or less is unclear—the bias in calculating depreciation and obsolescence costs that has just been discussed. If sufficiently strong, the downward bias could even provide some offset to the bias that results from calculating inventory withdrawals at original cost, although this offset could hardly be important in years when inflation is very rapid. In the memorandum sent to the Board in preparation for the present discussion, a note by John Meyer drew attention to these offsets.

One such offset is provided by accelerated depreciation, which the Internal Revenue Service has permitted in recent decades. Speeding up the deduction for depreciation and obsolescence reduces the lag between the time when capital goods are acquired and the time when depreciation is charged, and thus also reduces the difference between original and replacement cost. It should be stressed, however, that accelerated depreciation does not make it possible to recoup more than the original cost. The difference can only be reduced, not eliminated. Thus, also, accelerated depreciation serves to eliminate some of the profits that reflect merely a rise in the general price level (profits on which

corporate income taxes would otherwise have to be paid) but does not eliminate all the inflation profits or taxes paid on these profits. Nor is the acceleration geared to the rate, or to changes in the rate, of inflation. As a result, particular year-to-year changes in reported profits, and in the corporate taxes paid on them, may still be distorted.

A more subtle and perhaps more powerful offset mentioned by Meyer results from technological change. This tends to reduce the cost of maintaining the capacity of capital equipment to produce a given volume of output below the amount of depreciation charged. In addition, he mentions growth in the capital stock, which also serves to make current depreciation charges higher than the amount needed to maintain current capacity. These ideas, developed in studies by Evsey Domar and Robert Eisner, were considered (but only briefly) in one of the papers stemming from the National Bureau study of inflation. The issue, as stated there, is whether technological change and capital growth do in fact offset the underpricing of depreciation and obsolescence in the calculation of business profits, if depreciation and obsolescence are viewed as measuring reduction in the private value of plant and equipment rather than reduction in the capacity of plant and equipment to produce. The issue involves a difference between two points of view, the social and the private. The issue merits more attention than it has received. It would certainly deserve a thorough airing in any study of inflation accounting on which the National Bureau might embark.

The second group of questions concerns the deflator used to convert business profits in current prices to profits in constant prices.

One issue here is what index to use in deflating profits. If a single index is to be used for all companies, should it be the GNP implicit price deflator used in BCD or some alternative to it? Alternatives sometimes suggested are the implicit price deflator for private GNP, the "fixed weighted price index" for gross private product, the consumer price index, the all-commodity wholesale price index, and the industrial-commodity wholesale price index. Most of these indexes differ significantly over long as well as short periods.

Another issue is whether a single deflator should be used for all companies, or deflators be tailored to the particular situation of each company. In the case of wages and clerical salaries, the common deflator used is the national consumer price index, which reflects change in the average level of prices paid by all those in urban areas receiving this kind of labor income. It is known, however, that consumer price indexes in parts of the country do not move exactly parallel to the national average. Nor is it likely that consumer price indexes applicable to workers at different income levels even in the same city would be identical—were such indexes available. The question has usually been skirted, presumably on the ground that the differences are not large. Now, however, it is attracting attention because of the plans of the Bureau of Labor Statistics to broaden the coverage of its price index.

A similar question arises in the case of profits. Companies differ considerably with regard to the goods and services on which their profits are expended—by stockholders with their dividends, and by the company itself with the money it retains to replace and enlarge inventory and capital goods as well as for other purposes. These differences among companies in the composition of expenditures must be far wider than among workers. The range is from the small, specialized firm in one tiny corner of the United States to the vast multinational conglomerate doing many different kinds of business in many different countries, countries in which price levels change at diverse rates, and between which exchange rates may fluctuate widely for this and for other reasons.

The use of deflators specific to each company would, however, tend to eliminate some of the profits gained, or losses incurred, by a company. These are the differential profits or losses caused by changes in relative prices. The possibility raises another complicated issue. It involves a difference between those who think of the real profits of a company as measuring its contribution to the real national income and those who think of these profits as measuring the company's share in the real national income. Interestingly enough, the issue was raised in the very first Income Conference held by the Na-

tional Bureau almost forty years ago, as well as in later conferences. There continues to be much confusion—in the economic as well as the accounting literature—about it, however. It must suffice, here, to mention that the appropriate treatment in financial statements of changes in relative prices when making adjustments for inflation raises another issue that would warrant careful analysis in any study of inflation accounting undertaken by the National Bureau.

We turn, now, to the third set of questions about the deflation of profits. In addition to the effects of inflation on the costing of inventory withdrawals and depreciation and obsolescence, economists and accountants naturally think also of the effects of inflation on other items in the income account and balance sheet. Besides inventories and plant and equipment, the balance sheet includes, for example, holdings of such nondepreciable tangible assets as land. These are carried on the books at original cost, although their market value may have risen radically. The rise in value is therefore not included in the conventional measure of profits. There are also monetary assets and liabilities, the "real" values of which change in different degree and in different directions when changes occur in the purchasing power of the money in which they are expressed. When these changes in real value are ignored, as they conventionally are, the measure of change in real net worth is thereby improperly calculated. So, also, is the calculation of real net income, realized or unrealized, the magnitude of which must be consistent with the change in net worth. Some of these effects were considered in a National Bureau study by Raymond Goldsmith and Robert Lipsey some years ago. That the issues here also are difficult may be seen if one asks, for example, whether preferred stock is a monetary liability or an element of net worth. This particular question is one of many troubling the FASB.

Still other sorts of questions arise besides those on which I have been concentrating. These go beyond mere financial accounting and confront us with far deeper issues. Included are the effects of current accounting practices on business decisions, on investment, on taxation, on price-wage controls, and on economic forecast-

ing—to repeat the questions that put the present topic on the agenda of this meeting of our Board. And there are many special questions—concerning the public utilities and other regulated industries, for example. It is hardly necessary to spell out the bearing of conventional income accounting on all these issues. Consider, for instance, how income taxes are assessed. What are the consequences, in an inflationary era, for the distribution of the tax burden and of income after taxes, and for the economic growth of our country?

In fact, a host of issues arises when one considers the effects of accounting under inflation. Many appear under the broad heading of what economists call “money illusion.” Others come to mind when one speculates on what the distribution of national income would look like—during the period of adjustment and afterward—were escalator clauses to be introduced on a comprehensive scale, as some economists have been suggesting.

Even if a National Bureau study of inflation accounting were to be strictly limited to the accounting or measurement issues, we should consider whether the study would not be better if it were broadened to cover not only accounting for profits but also for other types of income under inflation. I have mentioned labor and farm income. In connection with these, too, questions arise—or should arise—about the measurement of income even in current dollars, as well as the best way to translate current-dollar income into constant-dollar income. Although not so often pointed out in popular discussions of wage or farm income as they should be, to recipients of these types of income, also, balance-sheet or wealth effects of inflation are relevant. Questions about capital gains, for example—real or nominal, realized or unrealized, and their bearing on income and income-tax status—must trouble citizens receiving various kinds of income and

standing at various levels in the size distribution of the nation's income. And so does the accuracy of the national consumer price index and its appropriateness to their particular situation—questions, as I have already mentioned, that are now being raised more frequently than before, as the BLS prepares to revise and extend its index. Indeed, even when limited to questions of accounting, the study could be made broad enough to embrace the measurement of the distribution of income not only by type but also by size of income, under inflation.

There is a long tradition of study of private and social accounts and measurements at the National Bureau. A few have already been cited. If we think back to the 1930s, we can recall William Paton's pioneer study of corporate profits as shown by audit reports, and the classic studies by Simon Kuznets and his associates, which introduced the inventory and depreciation valuation adjustment ideas to national income accounting. To turn to the present, the National Bureau's *Annual Report* just submitted to the Board lists, among others, studies under way by Michael Gort on profit rates, by Philip Cagan and others on the effects of inflation on financial markets and the rates of return to different kinds of securities, by Robert Gordon on the prices of durable goods, and by Robert Eisner on a system of income accounts in which capital gains are included. Some of these studies focus primarily on measurement problems. But none of the others can afford to ignore these problems.

The danger to avoid in any new study of inflation accounting on which the Bureau may decide to embark is that of trying to cover too much. But any study limited enough to be feasible would be better, and its objectives less subject to misunderstanding, if it were planned and carried out with the broad context I have tried to sketch here kept firmly in mind.